Geophysical Research Abstracts, Vol. 8, 07466, 2006
SRef-ID: 1607-7962/gra/EGU06-A-07466

Cloud Resolving Model studies of upper tropospheric dehydration due to tropical deep convection observed during HIBISCUS 2004.

D. P. Grosvenor (1), T. W. Choularton (1), H. Coe (1), G. Held (2).

(1) The University of Manchester, United Kingdom, (2) IPMET, S.P., Brazil.
(daniel.grosvenor@manchester.ac.uk)

It has been demonstrated that overshooting cumulus clouds may play an important role in regulating the water vapour content of the stratosphere through their dehydrating effect. Such overshoots produce temperatures that are lower than that of the environment allowing lower ice saturation mixing ratios and hence lower vapour contents than is possible with a slow ascent. This is one possible explanation of the observed aridity of the stratosphere relative to the mean ice saturation mixing ratio at the tropical tropopause. Key to this dehydration mechanism is the separation of the vapour depleted air and the ice formed as a result, via ice precipitation. This makes it likely that the amount of dehydration is very sensitive to the ice microphysics.

Such sensitivities are explored using the UK Met Office LEM Cloud Resolving Model by simulating overshooting, deep convective clouds, of various updraught speeds, as observed during the HIBISCUS project. Results show a reduction in the mean total water content in the TTL of $\sim$0.2 ppmv over a 1000km domain and a depth of 0.5km due solely to the dehydration mechanism for a single cloud with a maximum updraught speed of 25m/s and a cloud top of $\sim$17km. CCN and IN concentrations are found to have little impact on this upper tropospheric dehydration but are found to significantly affect anvil ice number concentrations and mixing ratios, which may have a bearing on the stratospheric water budget. The availability of IN at such high levels in the cloud is explored leading to investigation of pararmeterizations of homogeneous nucleation of haze rather than heterogeneous nucleation of IN. Self accretion of ice is shown to play an important role in the dehydration seen in the modelling results. This is a poorly understood process and so sensitivities to the parameterization of it in the

LEM are looked into.